DOCUMENT RESUME

ED 158 493 EC 111 894

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TITLE Development and Validation of Cognitive Screening Instruments.
PUB DATE Jun 78
NOTE 16p.; Paper presented at the World Congress on Future Special Education (First, Stirling, Scotland, June 25 - July 1, 1978)

EDRS PRICE MF-$0.83 HC-$1.67 Plus Postage.
DESCRIPTORS *Cognitive Development; *Early Childhood Education; *Identification; *Learning Disabilities; Neurology; *Screening Tests

ABSTRACT

The author suggests that most research on the early detection of learning disabilities is characterised by an ineffective and a theoretical method of selecting and validating tasks. An alternative technique is proposed, based on a neurological theory of cognitive processes, whereby task analysis is a first step, with empirical analyses as subsequent stages. The possible utility of this technique in addressing current prediction research issues is noted, such as developmental differentiation and integration, and modality specialization. (Author/SBH)

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Development and Validation of Cognitive Screening Instruments

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Running Head: Development and Validation.

Paper presented at the World Congress on Future Special Education, Stirling, Scotland, June, 1978.

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Abstract

It is suggested that most research on the early detection of learning disabilities is characterized by an ineffective and atheoretical method of selecting and validating tasks. An alternative technique is proposed, based on a neurological theory of cognitive processes, whereby task analysis is a first step, with empirical analyses as subsequent stages. The possible utility of this technique in addressing current prediction research issues is noted, such as developmental differentiation and integration, and modality specialization.

Development and Validation of Cognitive Screening Instruments

One of the most active areas of research on exceptional children over the last several decades is the development and predictive validation of psychometric techniques for the early detection of learning disabilities. Although not generally acknowledged, research efforts in this area may be seen, in part, as an extension of the lengthy history of investigations on the longitudinal growth of intelligence (Bloom, 1964), but with several refinements and additions. For example, the recent predictive research focussing on early detection has involved narrower age ranges in their samples than the early studies of intelligence, operational definitions have been concerned with specific abilities rather than general IQ, and special program implications have been suggested on the basis of atypical test scores.

Despite these changes of focus however, it appears that predictive studies for the development of early detection techniques are reaching an asymptote in their contribution to both applied and theoretical knowledge. Progress is hindered in part, by problems which plague all prediction research from statistical and design viewpoints, including well-known factors such as subject attrition and differential subject learning histories

between the time of prediction and criterion measures. There are other difficulties present in the current prediction research however, which are due to problems in the underlying conceptual rationales of the studies. These problems are even more critical than the former varieties, but little progress has been made toward their amelioration. In brief, they can nearly all be traced to the central need for a theoretical model to guide the selection, validation, and interpretation of measurement instruments. Predictive research of the last decade has not produced such a model, nor have models been adopted from other independent areas of research. Most notably, the advances in knowledge of human abilities (e.g., Horn, 1976) have largely been ignored as a possible rationale for predictive studies, particularly in the case of attempts to develop early assessment techniques for learning disabilities. This is unfortunate, because most early assessment research projects implicitly conceive of abilities as mediators for short and long term learning, and this conception has a long history in the study of individual differences (Estes, 1970).

Without information from contemporary human abilities research as a conceptual framework, predictive analyses have proceeded almost exclusively by pure empiricism. Predictor tests have typically been selected for varying or often unstated reasons, assembled into large batteries, and their statistical effectiveness

has been determined in a longitudinal design. Subsequent investigations often then adopt the tests which have been shown to be most effective, add a new set of tests of their own, and repeat the process of predictive validation. The overall result of this trend is a growing array of tests available for the early assessment of learning disabilities, but with no theories on which to interpret results, and only an intuitive sense of the relationships among the tests. Further, the lack of a theoretical rationale has pre-empted the logical design of subsequent special programs.

An alternative approach is clearly required then, which does not rely solely on individual differences data as a source of guidelines in the selection and validation of tests. Indeed, this need has been recognized generally in the derivation of theories of human abilities (Carroll, 1976). A potentially more powerful procedure is to use human abilities theory to derive a task analysis framework for the selection of tests and then validate and interpret the tests according to the theory. In adopting this approach, it appears necessary that the theory of human abilities that is employed satisfies at least three criteria. The first criterion is that the theory be based on multiple forms of independent evidence, not just a single research paradigm, in order to maximize its generalizability. This criterion is important in order that the theory hold potential for integration of

information in the diverse areas of research presently in evidence. Second, the theory should have specified the relationships between its basic premises and those of competing theories. This process is never complete of course, but the essential differences between theories and the potential for generation of testable hypotheses on their relative validities should be articulated. Finally, the theory should be sufficiently detailed that it may be translated to guidelines for the selection, validation, and interpretation of psychometric tasks. It is this criterion that makes possible the application of knowledge in human abilities to problems in individual assessment.

Simultaneous and Successive Syntheses

One model of human abilities which appears to meet these criteria is simultaneous and successive syntheses (Das, Kirby and Jarman, 1975, in press). As based on Luria's (1966a,1966 b, 1973a) neurological investigations, the theory proposes that simultaneous synthesis, which is a function of the occipital-parietal area, is processing of information in forms which are nonlinear, and for which the parts are mutually surveyable and accessible. Successive synthesis, which is located in the anterior regions, refers to processing of information in a temporal, sequence-dependent form, with only limited acquisition therefore, to individual elements. Simultaneous processing is

spatial in nature, although not exclusively so, as it is found also in some forms of syntax. Successive processing is identified most clearly in tasks requiring specific serial order for correct completion. As indicated in the schematic model in Figure 1, the two forms of synthesis are found in perceptual, memory (mnestic) and conceptual tasks. Further, the types of synthesis are not dependent upon the form of information input; either simultaneous or successive input in any of the modalities may result in one or the other forms of synthesis. The type of synthesis involved in a particular task is governed mainly by the planning function, and the demands of the task.

Insert Figure 1 about here

In terms of the three criteria for use of a theory in predictive validation, the simultaneous-successive model appears adequate. The first criterion, concerning independent supporting evidence, is met in many areas, for simultaneous and successive processes have a long history in quite diverse fields. In cognitive psychology, comparable constructs to these, but labelled as serial and parallel processes, are quite prevalent (Neisser, 1967). Many theoreticians in the philosophy of science and epistimology have proposed similar dichotomies (Ornstein, 1972), and current physiological research on the roles of the hemispheres in the brain also suggests these processes (Gazzaniga, 1970; Levy, 1974). With respect to the

second criterion, concerning the relationship of the model to other theories, the discussions in Das, Kirby and Jarman (in press) have outlined the comparative research to date.

Of specific interest here is the use of third criterion, that is, translation of the theory to guidelines for the selection, validation and interpretation of tests. This translation could take the form of a schematic model, utilizing the basic parameters of the theory. An initial form of such model is proposed here as shown in Figure 2. This model constitutes a rudimentary translation of the features of Figure 1 from Das, Kirby and Jarman (1975) into a chart for classifying the task demands of a given psychometric instrument.

Insert Figure 2 about here

For initial application to the general area of prediction of cognitive abilities, the possible sensory systems are restricted to the auditory and visual modalities. This is consistent with established views of the dominance of these two modalities in children's learning processes in the school years. As shown at the top of the classification chart, within each of these modalities information may be presented simultaneously or successively. The central processes involved in a given task are enumerated

vertically in the figure. Tasks may involve simultaneous or successive forms of processing, and within each of these, may be classified as mnestic (memory), or perceptual or conceptual. To the extreme left of the chart, a further dimension is added concerning the form of output, which is simultaneous or successive. As shown in Figure 1, then, 48 possible combinations are generated for the classification of a given test by the factors of (a) modality of presentation and (b) form of presentation, crossed with (c) the type of task in terms of mnestic, perceptual, and conceptual, (d) the form of synthesis, and (e) the form of information output.

The chart in Figure 2 has been used recently to classify many psychometric tasks for potential use in a validation study. Several examples of tasks drawn from research on aphasia that can be classified in this chart, and which may have both theoretical and practical significance in the early detection of learning disabilities, are syntagmatic and paradigmatic associations. Gerswhind (1970), Jakobson (1964), Pribram (1971) and Luria (1973 b) have suggested that there are two basic varieties of aphasia, those involving words which typically follow one another in syntactical structure, which are syntagmatic, and those involving words which can replace one another in syntax, known as paradigmatic. Syntagmatic associations are suggested to have successive syntheses as their basis, and paradigmatic associations involve simultaneous syntheses. These

tasks would be classified in cells 1 and 4 of the model respectively, and could complement a set of non-language tasks in order to create a process-oriented approach to the validation of tasks.

Through the present research in simultaneous and successive processes, and related studies, tasks have been found to fit nearly all of the cells in the model in Figure 2. By selection of tasks on this systematic basis, specific questions related to the prediction of learning disabilities may be addressed. For example, the cognitive processes responsible for learning disabilities can be analyzed for convergence or divergence developmentally (see Buss and Royce, 1975). Further, the degree of specialization of sensory modalities (Freides, 1974), which is a long-standing issue in the study of learning disabilities, can be assessed in a developmental perspective. Thus, rather than maintaining early prediction research as a mainly empirical endeavour, the model encourages the integration of this research into the mainstream of cognitive-developmental and neurological psychology.

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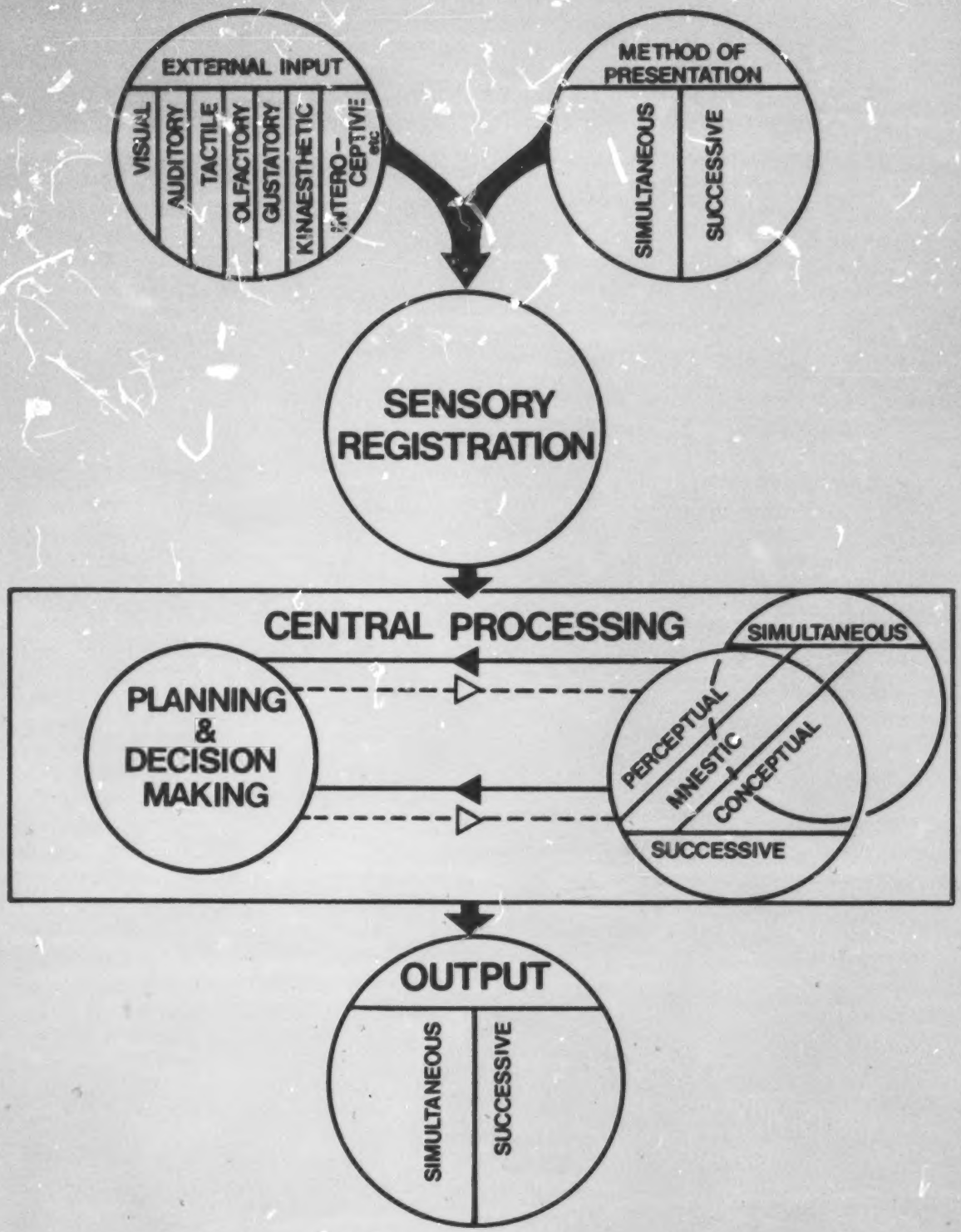
Figure Captions

Figure 1. Model of simultaneous-successive integration.

Figure 2. Task analysis chart.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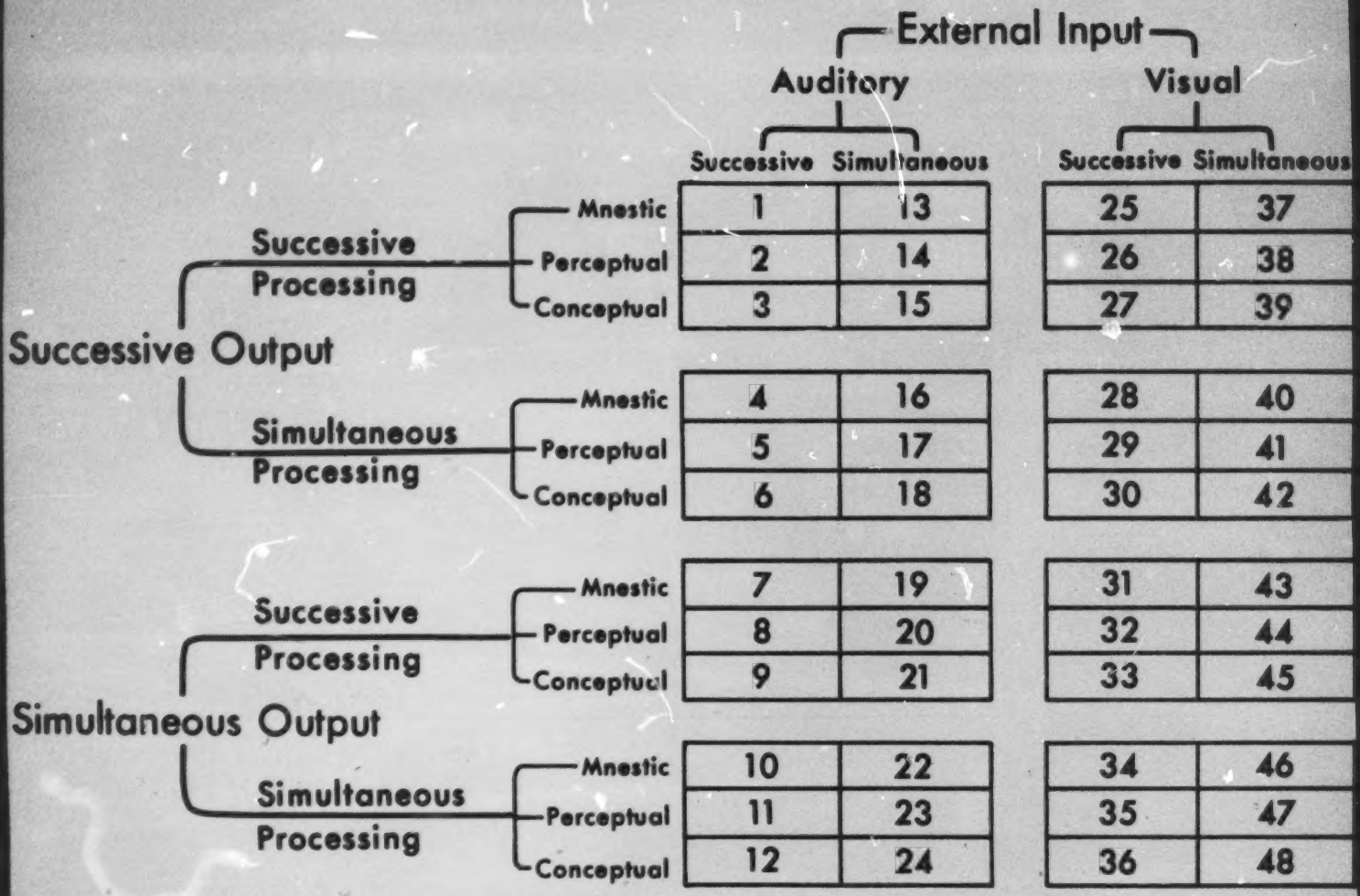
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